AAR MOBILITY SYSTEMS

Power Quality Issues with Small, Tactical Generators

Formerly AAR Cadillac Manufacturing

PROPRIETARY INFORMATION

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Agenda

- Introduction
- Power quality definitions
- Equipment that affects power quality
- Types of generators used
- Power quality issues observed
- Possible solutions
- Conclusions/Recommendations
- Questions and Answers

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Speaker Information

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AAR MOBILITY SYSTEMS

Introduction

PRODUCTS

- The World's Leading Supplier commercial off the shelf (COTS) Rapid Deployment Equipment for Military and Commercial Customers for Palletized Systems, Mobility Containers, and Shelters (Logistics, Medical, C2, Communications, etc).
- Custom Engineering and Testing Support, Turn-key Encampments, DoD and Commercial Shelter Repair and Integration

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Introduction

CAPABILITIES

- Engineering
- Assembly and Integration (hardware and systems)
- Repair and Overhaul (In-house and field service)
- Machining and Welding, Aluminum Preparation (etching and alodine)
- Bonding (hot/cold), Vacuum and Thermal Forming
- CNC Configured Composite Panels
- Finish Coating
- In-house certification and testing

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AAR Mobility Systems Products

ELAMS

MECC

Genset/ECU Trailer

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Customers & Qualifications

- Industries Served:
  - Military and Federal Agencies
  - Commercial Airlines
  - Transportation
  - Industrial
- Customer Quality Approvals:
  - US Government
  - EADS - Airbus Industries
  - Boeing
  - Lockheed Martin
- Quality Control
  - ISO 9001, AS9000, and QS 9000 Certified
  - FAA, JAA & CAA
  - Fully Compliant With U.S. Airworthiness Authority Standards

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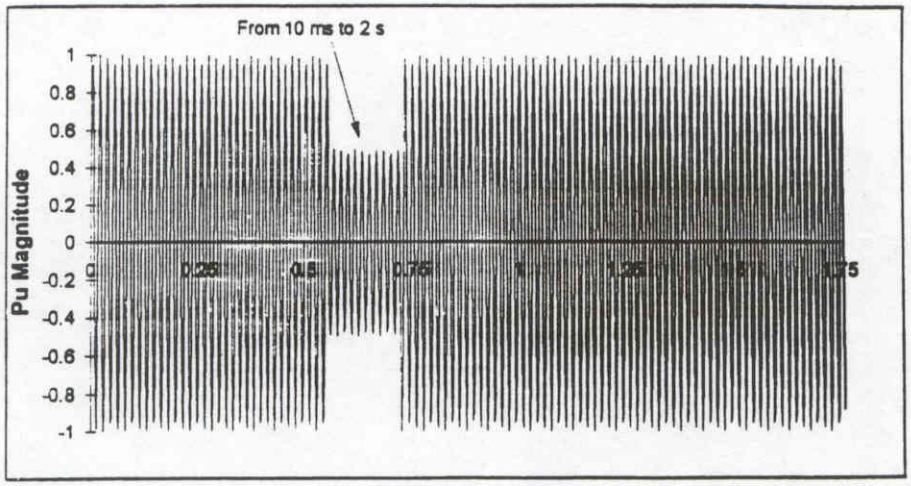
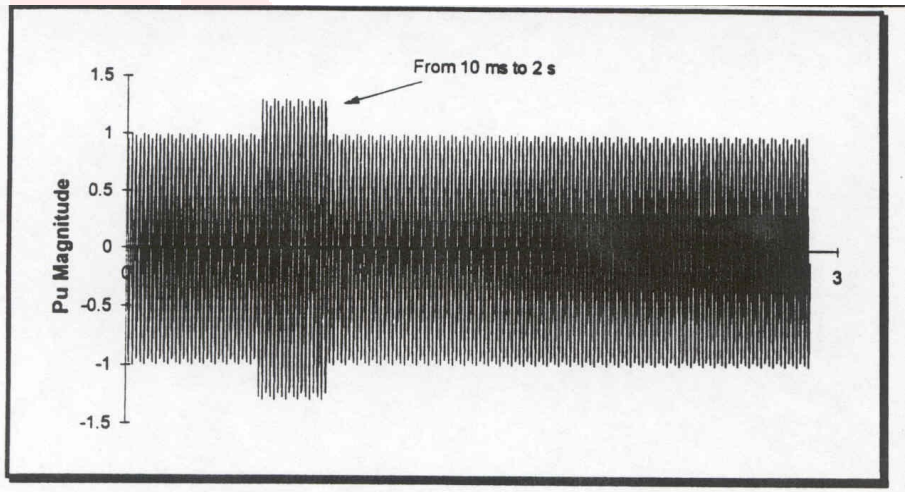
Power Quality Problems

- **Power Quality Definitions**
  - **Voltage Sags and Swells**



Voltage Sag



Voltage Swells

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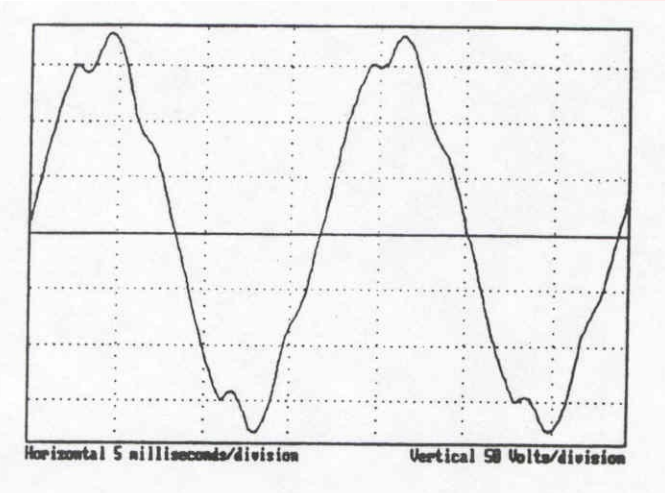
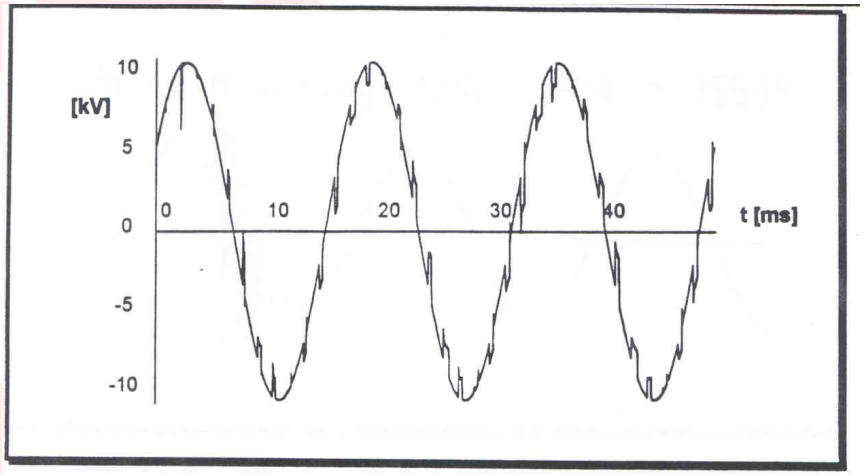
Power Quality Problems

- **Power Quality Definitions**
  - **Harmonics and Notching**



Harmonics



Notching

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Equipment and Power Quality Issues

- Types of Equipment that Effect Power Quality
  - ECU (Environmental Control Unit) – Sags & Swells
  - Industrial Motors (air compressors) – Sags & Swells
  - Machine Tools (heat guns, large drills) – Sags & Swells
  - Personal Computers – Harmonics & Notching
  - Radio Power Supplies – Harmonics & Notching

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Types of Generators Used

AAR has used two different types of generator sets in our shelter integration:

- Asynchronous generator using a solid-state voltage control system
  - This generator type used a high speed motor (3600 rpm), combined with capacitor banks
  - This generator also used turbo-chargers to handle the higher altitudes
- Synchronous generator using a voltage regulated governor
  - This generator type used a low speed motor (1800 rpm) with no capacitor banks

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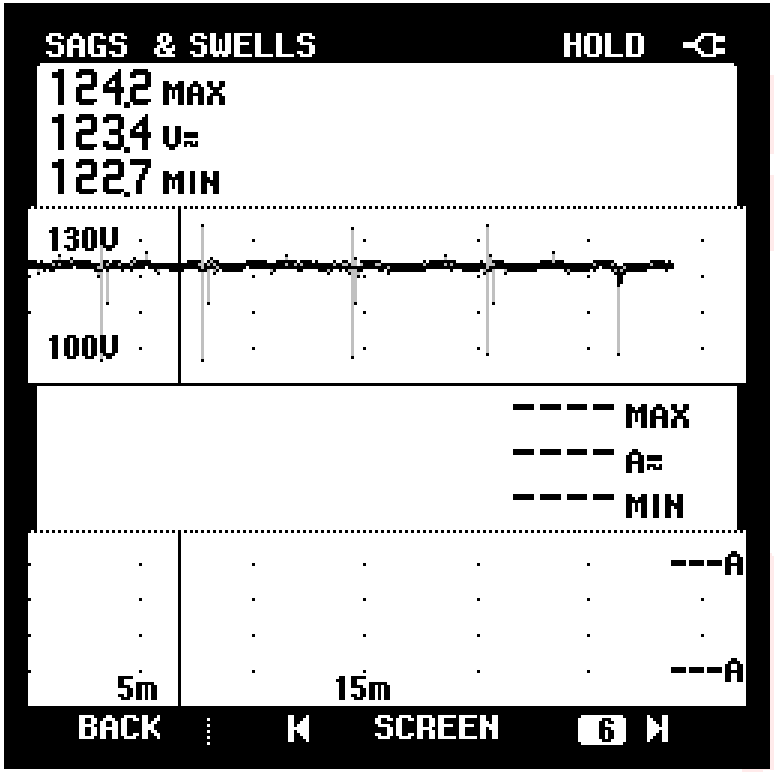
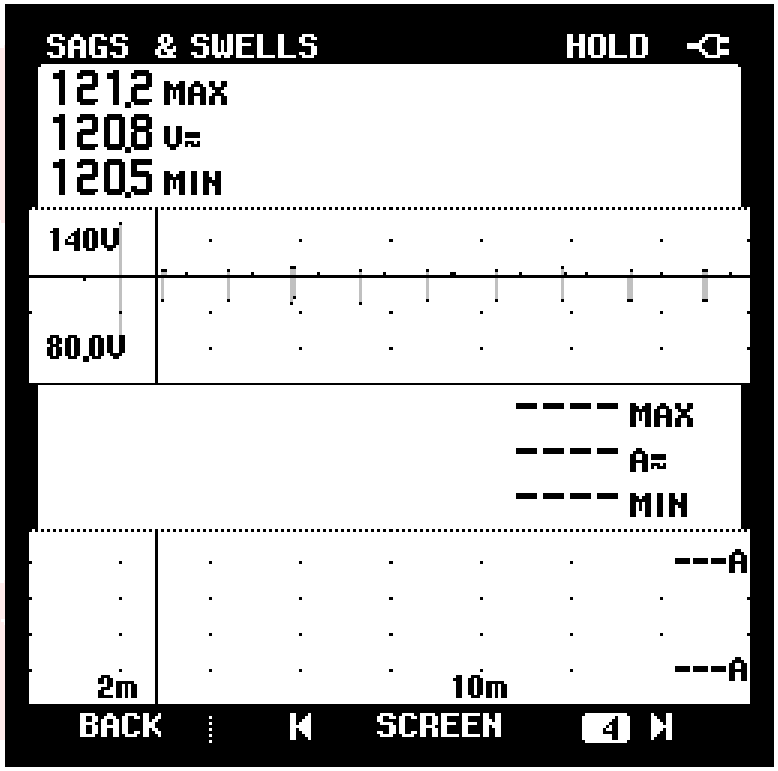
Power Quality Issues Observed



Screen Capture PQ Meter
Asynchronous Generator



Screen Capture PQ Meter
Synchronous Generator

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Screen images taken with a Fluke 43 PQ Analyzer

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Possible Power Quality Solutions

- Power Conditioners/Voltage Regulators
  - These are ferromagnetic coil transformers
  - Output levels designed to hold input voltage +/- 3% for 3 to 5 cycles
  - Can be hardwired into circuits or plug into a 20A outlet
- Uninterruptible Power Supplies (UPS)
  - These units are battery backup systems
  - Output level held at some voltage for some period of time
  - Cycling frequency of equipment maybe detrimental to battery life
- Larger “Prime Power” Generators
  - Often not practical due to size, weight, and asset availability

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Conclusions/Recommendations

- **Customer/Supplier Communication**
  - Customer has to communicate to the supplier their power needs and requirements, to include the type of equipment being used
  - Supplied needs to communicate to the customer the amount of power that will be available
- **Generator Type**
  - Asynchronous generators are good to use if powering non-inductive loads only
  - Synchronous generators can handle both inductive loads and non-inductive loads
- **Current System Designs**
  - The current design is to use a synchronous generator with a power conditioner/voltage regulator.

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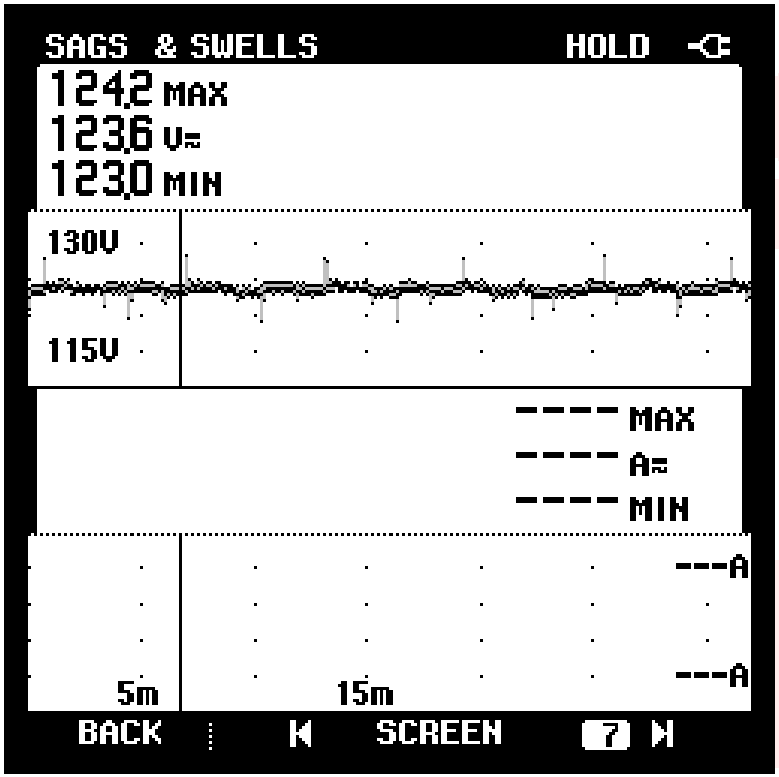
Power Quality Solutions Observed



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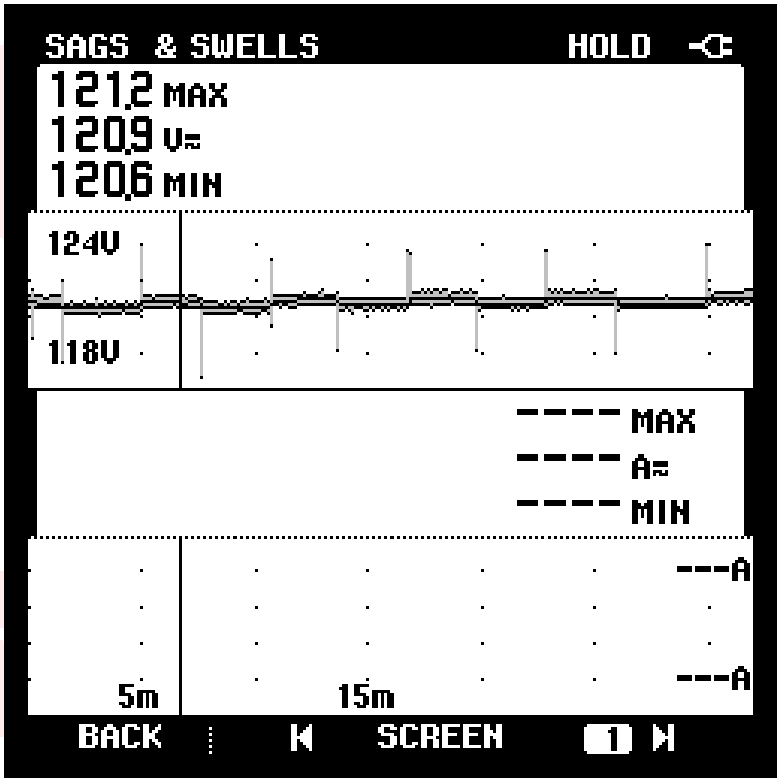

Screen Capture PQ Meter
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Question and Answers

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